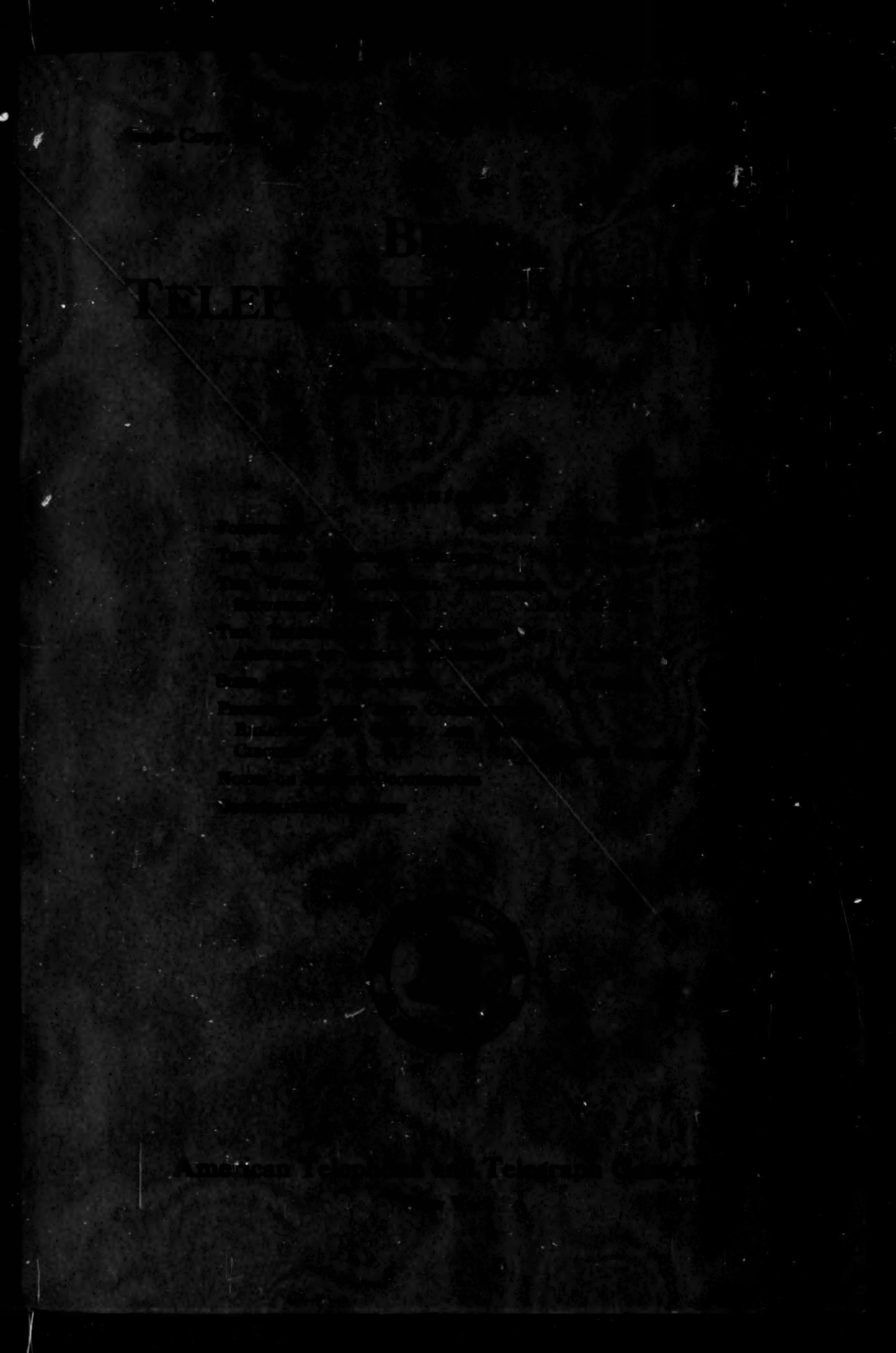

# BELL TELEPHONE QUARTERLY

A MEDIUM OF SUGGESTION
AND A RECORD OF PROGRESS

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# Foreword

BEING a young, active and progressive institution, the Bell Telephone System is continually doing new things, sometimes in service to the public, sometimes in operating technique, sometimes in commercial policy. The new thing may be done in any part of the country. These new things are interesting to telephone men in other parts of the country. If they are experiments in service or technique and are successful, they ultimately become generally known by being standardized and covered by specifications and described in bulletins. There are some even more important innovations, interesting even in the nebulous state and more so as they become accomplished facts, which the presidents and general officers would like to observe during the experimental period. I refer to the type of things which we have usually discussed in conferences of presidents and general managers. As a medium of suggestion, a report of progress and perhaps an announcement of results on matters of that type between conferences, we launch with this number the BELL TELEPHONE QUARTERLY.

H. B. THAYER.

# The Radio Telephone Situation

RADIO today is a magic word throughout the country and, like anything else occupying headlines, much has been said of it, both good and bad, which it has not rightfully deserved.

What is radio? While it would probably take volumes to give a complete explanation of radio, yet perhaps it can be briefly explained in the following manner.

In the ordinary alternating current electric light and power circuit, such as used to furnish light to homes and power to factories, the periodicity of the electrical current is almost universally sixty cycles per second. In other words, there are sixty complete reversals of the electrical current every second. At this low periodicity or frequency practically all of the electrical energy is confined to the wire system and none of it radiated into space. However, by sufficiently increasing the frequency or period of oscillation of an electrical circuit and by suitable circuit arrangements a large proportion of the electrical energy generated may be radiated into space as electro-magnetic waves. These electro-magnetic waves travel through space with the speed of light and have frequencies varying from around 15,000 to several million cycles per second.

In order to transmit a telephone message by radio the amplitude of the high frequency waves sent out is made to vary in accordance with the variation of current produced by the voice in an ordinary telephone circuit. The problem of producing these high frequency electrical waves and of thus controlling them by telephone currents has been solved in a satisfactory manner only by means of the three-electrode vacuum tube.

During our development of the vacuum tube in connection with the telephone repeater, we found that it was possible to make larger and more powerful tubes which could be used for radio telephony, and it was this development that brought about the memorable and remarkable experiments of 1915, when we talked by radio to Paris, San Francisco and Honolulu. Subsequently

the laboratories of the Bell System have diligently continued their development and research work, until today the fundamentals of radio telephone communication are fairly well established, and the kind of equipment necessary is generally known, although it has not been commercially produced except for such real uses as have been found in the field of telephone communication.

## The Patent Situation

At the same time development by others of radio and allied equipment was taking place and, as might be expected, it was not long before it was found that the patent situation was considerably involved and that the public would be unable to obtain the full benefits of radio unless some arrangement could be made between the holders of the patent rights which would permit of unhampered development. Accordingly, at the request of the United States Government, the General Electric Company and the American Telephone and Telegraph Company entered into a cross-license patent agreement, effective as of July 1, 1920. In general, by this agreement the American Telephone and Telegraph Company received licenses in the field of commercial and public service radio telephony, while the General Electric Company received licenses in the field of amateur radio telephony and all radio telegraphy.

Following the execution of the principal agreement between the American Telephone and Telegraph Company and the General Electric Company an extension agreement was entered into whereby the General Electric Company may extend to the Radio Corporation of America any of the licenses which the General Electric Company received under the principal agreement, and likewise the American Telephone and Telegraph Company may extend to the Western Electric Company any of the licenses which the American Telephone and Telegraph Company received under the principal agreement. Subsequently, the Westinghouse Electric and Manufacturing

Company, who also had been at work in the radio field, entered into the agreement in the same patent license fields as the General Electric Company and Radio Corporation of America.

Prior to all this, the Radio Corporation of America had been formed, had taken over the interests of the Marconi Company in the United States and had entered into an agreement with the General Electric Company whereby it acquired rights to use and sell all radio equipment which the General Electric Company was licensed to manufacture.

The situation today, therefore, is as follows:

In general, radio telephone equipment for commercial or public service uses is provided by the American Telephone and Telegraph Company or through its manufacturer, the Western Electric Company. Amateur radio telephone equipment, radio telephone broadcasting receiving sets, and radio telegraph equipment are manufactured by the General Electric Company and Westinghouse Company and are sold through the Radio Corporation. The underlying principle throughout this cross-licensing agreement is to insure and make available to the public the complete development of radio.

## Radio Telephony a Supplement to and Not a Substitute for Wire Service

The interest of the Bell System in radio lies in whatever application it may have to the possible future development of telephone services. In the Bell System or any other system based on sound economic principles, the fundamental consideration in any communication problem is the provision of the type of facilities which will give the best and most economical service to meet the particular set of conditions involved. In this there is made no distinction between wires and radio, as the premise is the proper type of communication and the conclusion may be wires or radio. However, it happens that the inherent features of radio telephony are such that

it has no economic or service application in the United States, or in any other place where conditions are similar, except as a supplement or auxiliary, in certain instances, to the wire service, but in no case a substitute therefor.

The real applications of radio are in communications across wide stretches of water, in ship to ship, in ship to shore, in airships to land, in possibly some other types of mobile stations, in some forms of broadcasting where the same communication is given simultaneously to a large number of people, and in remote cases where, due to geographical or other conditions, it is impossible or impracticable to place wire lines. All of these applications will be recognized as supplements to the regular wire service and not substitutes for them. For the regular telephone services both local and long distance, for which wires are now so extensively employed in the United States, the limitations of radio are such that it cannot be used.

## Radio Telephony Can Never Replace Universal Wire Service

The general telephone communication goal in the United States is universal service. This is merely a brief way of saying that any person, anywhere, at any time, can quickly, reliably and at a reasonable cost, talk with any other person anywhere else in the United States, and for this talk these two persons will have available facilities for their personal, private and uninterrupted use. Radio does not meet these requirements. It provides unguided transmission, sending out its message broadcast to anyone within range properly equipped to receive it, while wires, although they came first in scientific development, really represent the refinement of the art and provide guided transmission directed only to the person for whom intended. Scientifically it is actually more remarkable that we are able to guide messages by means of wires than to send them out broadcast by radio.

The number of communications which can be transmitted simultaneously by radio is narrowly limited.

Daily over 60,000,000 telephone calls take place over wires in the United States. In New York City 4,000,000 calls are handled per day and 100,000 calls per minute during the busy hours. The facilities of the ether within any reasonable practical range are so limited that but a very small fractional part of such an enormous volume of messages could be handled by radio. Further, the real applications of radio as hereinbefore outlined will undoubtedly demand greater facilities than the ether will afford and it is certainly desirable that the ether be conserved for such real and necessary uses. If this is not done, it will be almost hopeless to expect that satisfactory service can be given even in the real fields of radio.

The cost of radio equipment and operation for universal service would be enormous. The investment of the Bell System in the United States today is less than $200 per subscriber's station, including both local and long distance lines, and comprehending all the poles, wires, cable, conduit, equipment, land, buildings and accessories of the entire system. It is impossible to conceive at any cost any form of radio equipment which would provide the same universal telephone service.

However, suppose an attempt were made to set up such a radio service. It can be imagined to be along either of two lines: First, the apparatus at each subscriber's premises might be kept as simple as possible, and arranged only to connect that subscriber to a central office in a manner similar to that by which each subscriber is now connected by wire. Second, by making the subscriber's apparatus more complicated, the subscriber might be given apparatus enabling him to directly connect with other stations in his vicinity, and he would reach more distant subscribers by connecting to a central office. It is impossible to imagine any arrangement so comprehensive as to enable him to directly reach all other subscribers.

In the first case his apparatus would consist of both

transmitting and receiving equipment with suitable signaling and power apparatus and with some form of antenna. It would need to be much more complete and reliable than any of the present simple forms of amateur equipment. In this case the radio equipment would merely take the place of the wire connection between the subscriber and the central office, but the cost of the radio equipment would be much greater than the total cost per subscriber of the entire existing telephone wire plant. In addition central offices and trunks, involving very expensive and elaborate radio apparatus, would be required to complete the connections.

On the second assumption, part of the central office expenditures would be avoided, but the cost of the apparatus at each subscriber's station would run into thousands of dollars, and in addition a considerable part of the central office expenditures would still be necessary.

For long distance service radio has a more favorable application than it has for local service, but again it is found here that both in first cost and subsequent cost of operation it is many times more expensive than for wire circuits and does not approach them in reliability or freedom from interference and is not secret.

Thus the cost of a complete radio plant for either local or long distance service or both is far in excess of the corresponding wire plant, and not only is the first cost of radio equipment greater than for wire equipment, but the experience to date indicates that the cost of operation of radio is greater per dollar of investment than for wire plant. This means that radio telephone service, even if it were possible, must have rates, in order to pay the costs of operation, many times greater than charged for the present wire service.

From the above it is evident that the cost of radio service would be excessive and that the character of the very limited service which could be given by radio would be so far inferior to the service now given over wires that the general public, even if they could afford to pay for it, would not tolerate it.

The words of the Secretary of Commerce, Mr. Hoover, at the recent Radio Conference in Washington are interesting and to the point:

"I think it will be agreed at the outset that the use of the radio telephone for communication between single individuals as in the case of the ordinary telephone is a perfectly hopeless notion."

## Some Present Applications of Radio Telephony

Let us then consider some of the applications of radio telephony which in the present state of the art can now be foreseen. Between moving vehicles, ships, ships and shore, airships and ground, and similar classes of services radio telephony has an application. All of these are possible fields, and as time goes on, it may be expected that they will be developed into useful auxiliaries to the wire service. Recently interesting and successful experiments on ship to shore transmission were conducted with the United States Steamship *America*, operating by radio in connection with our Deal Beach radio station and thence over land wires to New York and other points. These tests showed that ship to shore service is possible but whether or not it is established as a commercial service must necessarily depend upon its value, which must be great enough to make the service self-sustaining.

Transoceanic wireless telephony is, of course possible, as was demonstrated by us in 1915. However, the present costs are very great and before it can be generally employed, the commercial value, as in the case of ship to shore, will have to be determined and assured. A factor operating seriously against such service is the great difference in time between countries located widely apart.

## Broadcasting

One of the most interesting applications of radio telephony is that of broadcasting, which is not intercommunication but a one-way service. It is in this field

that radio, by virtue of its inherent nature, seems to have great possibilities. At the present time broadcasting is being done by various departments of the Government, by certain manufacturers or agents of radio apparatus, by experimenters, by newspapers, and until recently by amateurs. The existing broadcasting transmitting stations are operating in the particular interest of the owners of such stations and are not providing broadcasting transmitting service for the use of the public in general. The American Telephone and Telegraph Company controls the important patents on radio telephone broadcasting transmitting equipment for general public use and consequently is being besieged with requests to sell radio telephone broadcasting equipment or to provide radio telephone broadcasting service. We are selling the broadcasting equipment and so many of these requests have been received that it has become apparent that if every one who desires his own broadcasting equipment should purchase it, there will soon be so many broadcasting stations all operating on the same or a comparatively few number of wave lengths that real service from any of them will be impossible. Accordingly, we are now establishing in New York on the Walker-Lispenard building a broadcasting station of the latest and best type known to the art. It is not planned that we put on any program ourselves but rather provide the facilities over which others may broadcast at specified rates. We could doubtless provide and broadcast a splendid program, but by such a procedure we would be inviting the public to purchase receiving equipment in order to hear our program and we would be committed to the indefinite continuance of a service for which no revenues would be received. By providing facilities for the use of others it rests with those who broadcast to furnish a class of program to which the general public will desire to listen. It is thought that in this manner the true attitude of the public toward broadcasting may be determined, as it is realized that at present the public is in a more or less optimistic state of mind and that broadcasting must be

placed on a much more sound basis if it is to remain as a valuable service.

If the experimental broadcasting station in New York is commercially successful, it is our plan to establish, as circumstances warrant, similar stations throughout the country, and not only may each station have available for use in connection with it all of the local lines in the zone served by that station but also at some future time it may be possible that all of such broadcasting stations throughout the country may, if conditions warrant, be tied together by the long line plant, so that any one, from practically any point, may use any number or all of these stations simultaneously if he so desires. It is our thought that only in this manner can the best, cheapest, and most extensive radio broadcasting service be given.

It should be understood that this service will not react to the exclusion of private or other broadcasting service and will not necessarily in any way directly displace such services. However, it is obvious that every one cannot own his own broadcasting equipment, and unless some provision for service such as we have outlined is made, only a limited number of people in the country will have broadcasting service available for their use.

## Present Laws and Proposed Regulations

The present radio laws, which were made originally in 1905 and later modified in 1912 and adopted by Congress, cover principally the international situation with reference to radio telegraphy, as radio telephone service was not practicable at that time. With the rapid development of radio telephony, particularly since the war, there has been a strong realization that the present radio laws are entirely inadequate for the present situation and not only is the international communication question now under consideration but also the national problem. During February the Secretary of Commerce appointed a Committee to consider radio telephone matters. This

Committee first met on February 27th and has been carefully considering the requirements for radio telephony with the idea through subsequent legislation, of providing space in the ether for the necessary and real services. It is proposed in the preliminary report of the Secretary's Committee that a large part of the available space in the ether be set aside for various kinds of broadcasting, with a small reservation for ship to shore, for transoceanic and for fixed station service. The temporary assignments which the Committee have suggested for the desirable uses of radio are naturally limited by the ether and by the character of practical apparatus so that no one of the services will probably receive as full an allotment as might be desired.

It is hoped that the proposed legislation will provide reservations in the ether for what now seems to be the possible applications of radio telephony to the public service in order that these applications may have an opportunity for development along proper lines. It is also desirable that there be established and maintained a rigid regulation of radio matters with the end in view that prime consideration will always be given to the necessary and essential uses of radio.

## The Bell System and Radio

While we have important exclusive rights protected by patents, our interest in the extension of our field of service overshadows any interest in any patent or group of patents. Above all, we do not want to obstruct the work or play of scientists and amateurs. Progress follows experiment and use. In this new art we should experiment and encourage the experiments of others but without prejudice to later enforcement of our rights if and when such enforcement becomes necessary to the efficiency of a public service.

The question of most interest in the Bell System is naturally—"What do we propose to do with radio?" We propose to keep in mind our main purpose which is

to furnish to the people of the United States as wide a range of communication facilities as possible. It may mean service with ships, railway trains and airplanes. It may mean a transatlantic service, but promises cannot now be made. It may mean broadcasting, the future of which cannot be determined as yet. It should be remembered that radio telephony, with its scope definitely limited by natural conditions, has only reached an elementary stage, even in its possible fields. Bearing in mind our fundamental policy of providing the best and most economical type of facilities to meet any given set of conditions, we shall continue our work of developing whatever possibilities there are for radio in the field of telephone communications.

A. H. GRISWOLD.

# The Work of the Bell Telephone Securities Company

THE Bell Telephone Securities Company is the latest addition to the group of companies which form the Bell System. The purpose of its organization is stated in the Annual Report of the American Telephone and Telegraph Company for 1921, and I need not set it forth at length here. It will be sufficient to say that its main function is to disseminate information about Bell System securities to the public, particularly to Bell telephone users, and, when desired, to advise interested investors and to facilitate their transactions in Bell System securities, and thereby to aid in securing a more widely distributed ownership.

Even now there is a wide ownership of the stock and other securities of the Bell System. The savings of several hundred thousand men and women throughout the country have gone into the building of the Bell telephone plant. But it will require the savings of many new investors to take care of future extensions. The demands for service now are heavy and they will continue with the growth of the telephone habit and with increases in population and business.

There are today over 197,000 stockholders of the American Company. The increase has been steady and rapid. In 1900 there were only 7,500 stockholders; ten years later the number had risen to 20,400; by 1915 it was 65,500; and at the end of 1921 it was 186,342. The wide distribution of the shares among individuals is revealed by the fact that 29 was their average holding; 176,085 stockholders owning less than 100 shares each.

Largely because of the fact that the telephone was invented in Boston and first financed in that locality, the Bell System and its securities are better known and understood, and the holdings are largest in New England and New York which today owns approximately 74% of it.

As the service has been extended, the ownership has spread; but it is desirable to increase this distribution still further. Very many more people over the Nation, who are the Company's customers, can and should acquire some of its stock. They can buy the stock in the market at a price which gives a reasonable return, and this is the only way in which those who are not now stockholders and are not employees can secure the stock.

This wider distribution of Bell System securities will add to the number of those who have safe investments. Customers who became shareholders, will take an interest in the Bell Telephone Companies and will acquire an understanding of their problems and needs. It will also lay broader financial foundations for the Bell System, and will aid it to secure, at a lower cost, the money needed for extensions of the service.

## Money Required for Extensions

It is clearly to the interest of the public, no less than to that of the System, that the latter's financial structure should be strong. It takes much money annually to provide for its new business. The requirements of the people for telephone facilities imposes the task upon the System of providing approximately $215,000,000 each year for additions and replacements. These requirements cannot be ignored. They must be met. The sum involved is huge even to people who recently have been taught to think in billions. Think of it in this way and the meaning of it can be grasped: The Bell Telephone System must provide more money each year, to give the public the facilities it demands, than any government in Europe, except those of Great Britain, Germany, Russia, Austria and Italy, expended annually for all public purposes before the Great War. The sum is greater than the yearly prewar expenditures of Spain, Brazil, Argentina, or Canada. It is much greater than the present annual expenditure of New York State. It is not much less than the expenditure of Japan in 1913, and it is two and a half

times that of the United States the year before the Civil War.

The greater part of the sum needed annually must be secured through the sale of stocks or other securities; and the System's financial condition must be such as to attract the funds of investors. No pressure can be brought to bear upon them. The Company cannot, like governments, secure funds through any compulsory process.

It is not contemplated that the plans to promote customer ownership and to secure a wider distribution of securities, will provide a substitute for former methods of raising new capital, but rather that they will supplement and facilitate them. It is expected, however, that they will result in substantial additions to the sum of money secured in other ways, and, especially, that they will promote better relationships.

## The First Campaign Succeeds

The organization of the Securities Company was completed, and the Company was ready to enter upon the tasks assigned to it on September 15, 1921. Before this date, there had been under consideration a campaign for the sale by the Southwestern Bell Telephone Company of $2,500,000 of 7% cumulative preferred stock. In a comparatively short time the requisite plans were completed.

The territory of the Southwestern Company is very large, and it was recognized that the task of organizing it would be exceedingly heavy. It was determined to organize it piece-meal and to make haste slowly. It was recognized that the economic conditions of the territory were not satisfactory. In fact, in certain financial quarters, we were assured that there was little or no money in that territory seeking investment and especially in a 7% stock to be sold at par. The Southwest is largely agricultural, and it was well-known that the farmers, especially the cattlemen, were hard hit. The oil boom

had collapsed; and the lumber industry was much depressed. Still, the officers both of the Southwestern Bell and of the Securities Company, were confident that reasonable success could be obtained.

The territory finally selected for beginning operations was in the division embracing Houston, Galveston and Beaumont. Contacts were established with local banks and investment houses, all of which expressed confidence in the Company and its security and willingness to cooperate. Meetings of the employees were held in each of the cities. Circulars were distributed and the requisite advertising matter was inserted in the leading papers. Immediately following the organization of this division, attention was directed to Kansas and to the development of the work in that State. Later the other divisions in Texas were organized. On November 21, 1921, the machinery was set in motion in Eastern Missouri, especially in St. Louis, and subsequently was extended throughout Missouri, and about the beginning of the new year the necessary steps were taken to begin the selling of the stock in Arkansas and Oklahoma.

On an average for the entire Southwestern territory, the campaign ran approximately three months and a half and the entire amount of the authorized issue was sold before March 25.

In this campaign, 25,000 shares of preferred stock were disposed of to approximately 6,500 people, the average number of shares sold to each purchaser being less than four. It is interesting and significant that at a time of great depression, so many individuals were able to save and willing to invest $2,500,000 in securities, and by doing so, to assist in providing additional facilities for their own use. These communities gain from being able to retain this sum of money at home for construction purposes, and the individuals gain from their investment in a sound security yielding a reasonable return. The Company welcomes the investors as stockholders, whose cooperation it will have in rendering the best possible service at the lowest possible cost.

### Typical and Instructive Incidents

Many interesting incidents occurred in connection with the sale of this stock. At Wichita Falls, Texas, a blind man purchased five shares of stock from a girl teller in the commercial office. When first told about the stock, the man said he had read nothing about it because he was blind. The girl then told the story of the Southwestern Company's 7% preferred stock, which interested the blind man very much. However, he left without signing the purchase contract. The next day he returned. He asked for the same girl and had her make out a check for his signature covering the payment on five shares. The following day he appeared and asked for the General Manager. He was taken to the Local Manager, to whom he said: "I am now an owner of your Company. I have found out that my next-door neighbor has been trying to get telephone service for over three months. As an owner of your Company I would like to know why you have not furnished him the service." The Local Manager saw an opportunity to clear up a situation. He explained that there were no telephone facilities in the neighborhood at that time and that a special installation in advance of the completion of the regular construction, which was under way, would cost $400 or $500. The blind man got the story thoroughly. He slapped the desk emphatically and said: "As one of the owners of this Company I would not let you give that man service at such an installation cost. I will go back there and explain to him that he should wait until your new cable is installed."

In another Texas town, a prominent citizen had a prejudice against corporations in general. A telephone man was at his residence repairing his telephone, and when the job was finished, attempted to sell Telephone Preferred to the gentleman's wife. During the conversation, her husband came in and listened attentively. Finally he told the telephone man that if all the public service companies' employees were as interested and as

loyal as he, the companies would never have any trouble with the public, the commissions or the courts.

An encouraging result as the campaign progressed was the change of attitude in the financial quarters previously mentioned. After our campaign had been running a few weeks, an offer was made to underwrite $2,500,000 of the issue. This was not accepted, but investment houses were allotted $1,000,000 to sell on the same commission as that paid to telephone employees. Other underwriting offers were made by eastern bankers.

The attitude of the banks was decidedly friendly. Many of them made direct sales; all spoke well of the stock when investors sought information from them. They recognized that our partial-payment plan fosters thrift and thus helps the community. The friendly attitude of the banks increased the feeling of confidence among their patrons and had a most helpful reaction throughout the territory.

### Wisconsin Makes a Record

The next large task of the Securities Company was undertaken in cooperation with the Wisconsin Telephone Company. That Company planned to sell $5,000,000 7% Cumulative Preferred Stock. The resulting campaign which has just closed with an over-subscription of several hundred thousand dollars, is a pointed example of the working out of the formula—

Preparation + Enthusiasm = Success.

In the Wisconsin territory, which is compact, an intensive plan was adopted. Work was to begin March 1st and to last from six to eight weeks. Of the issue of $5,000,000, it was hoped to sell $4,000,000 during the campaign, and the remainder during the next few months. Every employee had a place in the selling organization; the necessary routines and forms were ready; and publicity material was prepared and ready for distribution. But on February 22nd and 23rd the State was swept

by the worst sleet storm in its history. Over 10,000 telephone poles went down, and all forms of transportation were paralyzed.

Because of the damage, the derangement of traffic, and the necessary resulting work of restoration, which fully occupied the Wisconsin Company's plant forces, it was announced that the opening day would be postponed until March 6. However, some of the material was already in employees' hands, and the banks had started their publicity work, so it was decided to let those go ahead who could do so. Under these severe handicaps, the Wisconsin Company made advance sales of $3,100,000 worth of stock; and before the end of the fourth day after the formal opening (March 9th, to be exact), the entire $5,000,000 had been over-subscribed. Approximately two-thirds of the stock was sold for cash; employees sold a little more than half the issue; the sales averaged less than five shares for each purchaser; and as a result, the Wisconsin Company has about eleven thousand new stockholders.

While, of course, no pressure was brought to bear on any employees to make sales, yet the fact that everyone was assigned to a definite place in the campaign organization was a great impetus to them. A quota of 6 shares for every employee was used in figuring the quotas of the various exchanges; and on this basis, 22 out of 80 exchanges had "gone over the top" in the first four days. Oconomowoc, the first one to pass its quota, did so by four o'clock the first day announced for the opening of the campaign. Its quota was 132 shares and up to Friday night, March 3, it had sold 404 shares.

In his comment on the campaign, President McGovern says: "One of the outstanding features of this sale is that many people did not seem to look into the real merits of the stock, but relied very largely on what our people said to them. Of course, the fact that most all the banks in the State are favorable to our stock proposition, has very materially assisted in the sales."

### Fine Public Relations

As in the Southwest, so in Wisconsin, there were happenings which reveal not only the enthusiasm and enterprise of the employees but also the good-will of the people and the satisfactory relations which such a campaign establishes.

At Oshkosh, one of the linemen was very much discouraged because he thought that he would be unable to make any sales. His spirit was good, but he was afraid that stock selling was too complicated for him. The plant supervisor did his best to encourage him, but apparently with little success. The next day the lineman came in smiling and said that on his way home he had stopped in to have his shoes repaired and had sold the cobbler $2,500 worth of stock with very little effort.

Early in the course of the campaign, a charwoman working for the Company, who spoke very broken English, came to the desk where telephone bills are paid and without any comment handed in five $20 bills. The teller asked her what the money was for. She replied in rather broken English: "Stock—corner grocer." After a great deal of difficulty it developed that the charwoman had sold a share of the stock to a corner grocer, had collected $100, and had not even given him a contract or receipt.

The first share of stock in the Wisconsin campaign was sold by Miss Bond. This sale was made to an invalid woman, who had read the Company's announcement of the sale of stock and telephoned in, asking to have someone come out and explain it to her. Miss Bond responded and had no difficulty in answering the woman's questions and in making the sale.

In a certain section of Milwaukee, there is a German shopkeeper who is very influential in his community, and who has generally been opposed to the Wisconsin Company. On the whole, he has been rather anti-corporation. One day this storekeeper telephoned in to the security manager's office and asked him to send a number of stock

application blanks to his shop. In explanation, he said that his friends and customers were coming in to his store, that they were discussing the stock, that he thought they ought to be purchasing some, and that he wanted a supply of blanks for them.

The success of this campaign evidences not only the confidence of the people of Wisconsin in the Wisconsin Telephone Company but also their thrift and their readiness to invest their savings in sound securities.

### Pointing Out the Desirability of American Telephone and Telegraph Stock

A third undertaking of a slightly different type is that in cooperation with the Chesapeake & Potomac Telephone Company in the District of Columbia, West Virginia, Maryland, and Virginia, and the Bell Telephone Company of Pennsylvania, embracing Pennsylvania, Delaware and the southern part of New Jersey, to secure a wider distribution of American Telephone and Telegraph stock in those territories. I have already pointed out that it is desired especially to interest the users of the Bell telephone throughout the Nation, in the stock of the American Company. New stock of this Company, when issued, can be offered only to stockholders, and, under certain regulations, to employees; and the only way in which others can secure the stock, is either by purchasing rights, or by buying the stock at the market. In the territories of the Chesapeake & Potomac Company and of the Bell of Pennsylvania, through the employees of the Company with the cooperation of banks, the attention of subscribers was called to the American Telephone and Telegraph Company stock. Steps were taken to furnish them full information concerning its investment value, and it was indicated that arrangements could be made in many cases, if it was desired, for them to pay for the stock in installments. The undertaking has met with a very hospitable reception and large response. Many who were not acquainted with the stock and its

value, welcomed an opportunity to know about it and to invest their savings. It is estimated that as a result of this work there will be a net gain in these districts of between 3,500 and 4,000 non-employee stockholders of the American Telephone and Telegraph Company, purchasing from 35,000 to 37,000 shares.

It is clearly desirable that investors throughout the Nation be informed concerning the securities of the Bell System, their safety, and how they can be acquired. Numerous inquiries alone indicate that it is desirable to spread such information. The Securities Company is therefore planning to keep before the people of each community by means of window cards, bill enclosures, and in certain cases through advertisements or circulars, the kind of Bell System securities which subscribers might interest themselves in, and the steps they should take to purchase them. As the securities must be purchased in the open market, we plan to have the purchaser file his order, to assist him in securing its execution with the minimum delay and expense through a bank or a responsible broker with which he may wish to deal, and in certain cases, where payment in installments is desired, to assist him in arranging with some bank to handle the transaction.

These, and other activities of the Securities Company which will develop along appropriate lines as circumstances suggest, will involve in most cases close cooperation with the Associated Companies and the intelligent and enthusiastic participation of their employees. These things we know that we can always confidently count upon; for the keynote of the Bell System is teamwork and high consideration for the Company's welfare as well as for that of the American people whom it serves.

D. F. HOUSTON.

# The Telephone's Development

*Some of the early history of the development of the telephone art as freely edited from the verbal testimony of John J. Carty, Vice President of American Telephone and Telegraph Company, in charge of development and research, before the Public Service Commission, State of New York, at Albany, New York, March 15, 1922.*

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IN the beginning of the development of the telephone art—when the telephone was first being introduced to the public—all that there was to the telephone system was a couple of telephones and the principle upon which the telephone could work. That principle was known. There were two telephones that would barely work and there was about 100 feet of wire tying them together. It was almost impossible to hear through the instrument even in the next room. In fact, it was said by some that you could not hear at all, but speech was transmitted. That was all that there was to start with and all that was known about the telephone was known by Mr. Bell and Mr. Watson. Watson was the man who made the original telephone, the man who heard the first words; Bell was the one who spoke them; and between them those two men knew all there was about the telephone and nobody else in the world anywhere knew anything about it. That is what we had to start with.

Attempts were made to talk over an actual line and finally talking was accomplished from Boston to Cambridge; but there were no signalling devices and no telephone circuits as we know them now, so that to start with they copied the telegraph line, which was a line of iron wire run upon house-tops and using the ground as an earth return.

To illustrate how little was known about telephoning at that time: a copy of the instrument exhibited by Bell at the Philadelphia Centennial, in 1876, was taken to

England by Sir William Thomson who was the greatest scientist of the time. When it reached England it was somewhat damaged and there was nobody there that could make it work.

The instruments were soon modified into a little different type so that talking could be accomplished over a line, say, a mile or two long. It was necessary to talk and listen through the same instrument, there being no special transmitter then, but the telephone was put to the mouth and then to the ear alternately. It was soon found that while the telegraph line worked very well for telegraph it did not work well for telephone because of all sorts of difficulties, noises and cross-talk from telegraph circuits lightning storms and other serious disturbances.

There were no telephone switchboards and the early switchboards were telegraph switchboards used to change a line once a day or so without any regard to speed. The telephone switchboard must change the switching of the lines hundreds of times a day. The problems are quite different. There was no cable of the telephone type that was satisfactory. A half a mile or a mile of the cable was more than these instruments could talk through. For several years the instrument was regarded, and with much reason, as but a scientific toy without business importance. In those places where we succeeded in getting it in business houses, it was largely through favor rather than on the merits of the instruments and it was regarded as a business nuisance and a scientific toy.

With the art in such a miserable state and so much unknown, and such a multitude of difficulties it was found very difficult to make any business arrangements at all to get it introduced because conservative and capable business institutions felt that it was entirely speculative. The plan adopted was to induce individuals in different localities to take out licenses, the object being to introduce the telephone throughout every part of the United States. All through the country licenses were issued to small concerns, men, of course, who had no experience whatever in the business and with absolutely no knowl-

edge of it, but who were attracted by its novelty and by the arguments that were made to get them to come in.

Difficulties were encountered by everybody who undertook to install the telephone—by all of the licensees—and they knew nothing about the troubles or their remedy, or whether there was a remedy or not. They were constantly appealing to the licensor company for help and arrangements were made to render the service required to give them help in their problems. Laboratories, in which Dr. Bell and Watson worked and in which they invented the telephone, were taken over and Mr. Watson was put in charge and the staff was begun. They first thought that perhaps medical men who knew all about the ear and the voice might be able to solve these problems but they could give no help whatever, although the best of them were consulted. The company then went to professors of physics. There were no professors of electrical engineering at that time because there wasn't any such thing as an electrical engineer, or electrical engineering.

But they gathered together the very best men that could be obtained at that time to advise the licensees, not only on the technical side, but on legal questions, on questions of how to keep books in this new sort of business and other problems that arose. So that there started and grew up at once a nucleus of what is now often referred to as the staff at headquarters, being the general staff. They were what we might now call liaison officers, to obtain the best understanding with the licensees and help them out the best way.

## Transmitter and Receiver Development

For a long time there was no real transmitter as we know it, it being necessary to use what we now call the receiver for talking as well as for listening. The first instruments did not have any permanent magnet so it was impossible to use an ordinary telephone receiver without carrying around a battery with it. One of the im-

portant steps was to introduce a permanent magnet. The receiver passed through the stage to where, I suppose, we tried out thousands of different types, many thousands of different models, and a few years ago, I counted up the number that were actually made standard and there were about 50 different types that had been standardized from time to time and then superseded by others.

Early transmitters were what we call magneto. There was no battery at all. It was just like talking through the telephone receiver and they were very lacking in power and it was possible to talk for only a short distance. Then came the battery transmitter, invented by Blake, the use of which was a very revolutionary step forward, but with the need for greater and greater distances of talking over longer and longer wires, it became necessary to have transmitters that were more and more effective. The transmitter of Blake was superseded, after passing through a long series of evolutions itself, by what is known as the granular carbon transmitter which, instead of fixed pieces of carbon working against a piece of platinum, uses granules of carbon that are actuated by the diaphragm. The original granular carbon transmitter came from a minister of some church in England, the Reverend Mr. Hunning. The Bell Company bought his patent and a long series of experiments was undertaken and finally the idea of Hunning was made available for the public. He would not have known his own transmitter.

From the Hunning transmitter has been developed the transmitter that is now used universally in this country and is also the standard all over the world wherever they have the best instruments. Of course, even now we are constantly working to perfect these instruments still further. Something over 70 types of transmitter have been made standard from time to time and replaced by others.

### Improving Transmission

In the beginning it was necessary to use a telegraph line, which was made of iron. The iron and the telegraph

construction worked very well indeed for the telegraph, but it did not work so well for the telephone, because the telephone was the most sensitive instrument known and it was capable of being actuated by very minute currents that would not interfere with the telegraph. We had great difficulty with cross-talk and all kinds of devices were tried to remedy difficulties arising from induction. There were literally hundreds of these induction killers. They were very successful in killing the induction but they also were successful in killing the talk so that nothing ever came from that line of development.

A wire was strung from Boston to Lawrence, about 26 miles, on telegraph line. Anybody listening on that telephone line could hear all the telegraph messages. It was as though we had, as I once said, an old-fashioned drum corps and each drummer began drumming a separate tune.

All kinds of experiments were tried. We tried the use of different kinds of steel and iron wire. Wire was run from Boston to Lowell that had a spiral cut all around it. Somebody had a theory that the voice would follow that spiral. A line of four iron wires was built from Boston to Providence and on Sunday, when nothing else was doing on the wires, it was possible to talk on one of them, but if you tried to talk at the same time on the other wire, there was confusion. Then, to make matters worse, a new fangled telegraph system was started which used very high frequency current and that practically destroyed the business of the line altogether.

There was tried out between Boston and Providence, at my suggestion—in fact, I tried the experiment myself —what is now known as a metallic circuit. Instead of using the earth as a ground, a return wire was employed. That is now the standard and the strange thing is that we ever did use the ground.

This metallic circuit experiment was a very great success and we planned to build a line to New York, but there were limitations in the iron wire itself, even using the metallic circuit, and when we put a number of these

circuits on the same line, we still got cross-talk. These difficulties were overcome by the development of hard drawn copper wire which is one of the most fundamental contributions that has ever been made to telephony. A line was built from New York to Boston, using the hard drawn copper wire, but we still had cross-talk from neighboring circuits and that had to be overcome, so a method of transposition was adopted. All of the licensee companies experienced these same difficulties with line trouble during the early days of the telephone history, and when the general staff worked out a solution for a trouble for one of these licensees, it took care of all the rest at the same time.

In working out the increasing distances over which one could talk, we had to take into account, not only the line, but the instruments. There were two schools of thought. At an International Congress which I attended in France, the best European thought was to solve the problem of talking from New York to San Francisco by loud speaking transmitters. We had studied the problem ourselves and reached the conclusion that the loud speaking transmitter was not the way to accomplish the purpose. If we used the loud transmitter, it would be necessary to put in more complicated apparatus in the subscribers' stations and more powerful batteries and switches, and the cross-talk with these instruments would require a re-arrangement of the switchboards and cables which would cost many millions of dollars, so we made the attack on the line.

When the electric trolley was introduced, it presented a very serious problem because the noise it caused in the telephone circuit made talking difficult and in many cases impossible. Also, current from the trolley wires operated the central office switchboard signals and caused currents also to flow through the ground and onto the lead cables of the telephone companies, corroding the cables by what is known as electrolysis. After a number of years of working, a practical solution of this electrolysis trouble was arrived at and was adopted by all of the licensee companies.

The extension of high tension circuits of power lines also presented serious problems. To meet them, various measures were adopted. One was to devise protectors, an apparatus designed to produce as near practical immunity from fire and personal hazards as possible. The study of the problem of high tension circuits is still being continued because what was high tension at the beginning, is now very low tension. Two thousand volts was high tension and now we are talking about 200,000 volts.

## Cable Construction

As the demand for telephones increased, it became necessary to devise a solution for the problem presented by an increasing number of overhead telephone wires. For physical reasons and also for legislative reasons, we had to put our wires underground. We did not know how to make them work if put underground. That was the problem presented to the general staff, a problem, of course, which they had been working on from the beginning, but very intense work was conducted. While it was possible to talk for considerable distances when the wires were on poles, it was found that a mile of cable would cut down the transmission as badly as 100 miles of open wire. The first cables that were employed were rubber or gutta percha, both of which were good insulators as far as keeping the current on the wire was concerned, but for some reason or other, they seemed to destroy the talk. Early in 1881, I participated in experiments which were conducted by the licensor company when all the possible types of cables we could think of were put down. Cable was run in the neighborhood of Attleboro, Mass., between the tracks of the railroad for a number of miles, in which all sorts of devices were tried out. The first big advance or help that we got was in the introduction of cotton into the cables instead of rubber. Cotton had always been regarded as a very poor insulation but it was found that this was due to the presence of moisture and by heating the cable and driving out the moisture and

quickly covering it with lead pipe, a very high degree of insulation was obtained and it was much less objectionable than the rubber because you could talk farther through such a cable and cross-talk was not so great.

Many experiments were conducted with that type of cable and a great deal of it was put down, but in these experiments of 1881–1883, cable half a mile long of the best that we could manufacture so impaired the transmission over the telephone line that talking to the suburbs of Boston was very greatly hindered, or even prevented, by the interposition of a mile or a half mile of cable.

The cable problem had to be solved before the wires could go underground, and the solution did not come before the wires accumulated so rapidly that the authorities ordered them underground. As a matter of fact, Mayor Grant sent his men out with axes and actually chopped down the poles in New York.

The cotton cable was very greatly improved and finally it was superseded by paper, and the paper cable was put through a process of evolution until now it is the type usually employed. The experiments conducted by the general staff on this problem were continuous and were directed, not only to developing local cable, but also to developing long distance cable. Another way to state this problem is to say that it involved making the cables cheaper and also making cables so that we could talk through them. Of course, there is no use in making a cheap cable if you could not talk through it. So that, as in all the work we do, we have got to look to service first, and then, keeping the grade of service right, go as far as we humanly can in making it more economical.

It is interesting to trace the development of the 2,400 wire cable, which is one of the most recent types, following a long series beginning with the earliest type of rubber cable and thence going, by various stages, to a type of cable that would give only 100 wires in one sheath. That 100 wire cable cost as much, or probably more, than the 2,400 wire cable did. But that is not all. Space underground in New York is so precious that in certain regions,

it is almost impossible to get any more room for ducts, so that, unless these cable improvements had been made, there would be certain parts of New York where it would be hard to supply service at any cost.

Long distance telephoning was another problem altogether. To talk through long distance seemed, at times, to be forever an insuperable difficulty. One of the important steps was the invention of the loading coil by Dr. Pupin. He had a very good idea and our company obtained his patent rights but, as is usual in such cases, the patent, while explaining the principle, did not by any means show how to make it on a practical scale. Our progress in developing long distance cable transmission was something like this: we succeeded in talking very well through a cable from New York to Newark with the Pupin coils and other arrangements in association with them. Our further work carried us to Philadelphia, and by further research, we were able to talk to Wilmington, Delaware, and finally to Washington. Still continuing to develop, always making new discoveries and advancements, we succeeded in talking all the way underground from Boston to Washington.

The congestion which was encountered in the local wires in the beginning is now being felt in the trunk lines joining the different cities together. They are becoming so numerous that they have to be put into cables, so that the problem having been solved locally, we have to go on and solve it all over again for long distances. At the present time, we have, by means of a remarkable new type of cable, succeeded in talking from Boston to Harrisburg, and our experiments show that we now have a type of cable that will talk all the way from Boston to Chicago, and in fact, the cable is now being extended to that city.

One of the important phases of cable development is the effect of the growth of central offices upon the use of cable. The larger the central office became, the greater the congestion of wires in the neighborhood of the office. One central office in the early days had 2,400 wires coming

in from four directions to the roof, and a sleet storm came, weighted the wires and that pulled over the structure and almost took the roof away. Large central offices would be impossible without cables and when we have advanced the cable art, we have made larger central offices possible. These two factors react on each other.

## The Evolution of the Switchboard

The switchboard in the beginning, as I have said before, was a telegraph switchboard, a very crude type, very good indeed for the telegraph, but not swift enough or certain enough for the telephone. These switchboards were used and soon, under Mr. Watson and his assistants, began to be improved until a very good switchboard was evolved for one operator only. That was about 1878 or 1879, but as the number of lines grew, we had to have more operators, and then more switchboards. These operators had to call out to each other for the lines that they wanted, and the central office soon became a sort of bedlam. The methods of connecting were very imperfect and interconnection between one operator and another, or from one office to another, was attended, even under the best circumstances, by great delay, by extraordinary errors, compared to what we now have, and by constant cutting off and intermittent conversations.

The switchboard immediately began a process of evolution. These difficulties of communicating from operator to operator were overcome in the multiple switchboard which was one of the very important and permanent contributions to the art. By means of the multiple switchboard, if an operator receives a call for a subscriber in her own central office, she could connect directly to that subscriber without asking somebody else to help. That principle is still employed.

The early switchboards had very imperfect signalling devices and in general, were very, very crude. In the beginning, the central office operator had no power generator as we now know it, and she would have to turn a

crank the way the subscribers formerly did and now do in the country.

The business continued to grow, notwithstanding all these difficulties, and about 1886 and 1887, quite a large number of telephones had to be provided for the down-town offices in New York City. They were scattered in two or three different offices and worked so unsatisfactorily that it was decided to consolidate them. This consolidation presented a very serious switchboard problem because with these large switchboards, the cost seemed to go up, not in direct proportion to the number of subscribers, but in almost geometric proportion, and it was difficult to get them to work, and looking forward at the complications and the expenses of such switchboards, it was really appalling.

The general manager of the New York Telephone Company stated several times at conferences, that the best he could see in regard to the switchboard problem was that it meant that all he had to do was get enough telephones, and the company would go broke. The expense seemed to be going up and would have gone up, if we had kept on that track, at a rate very much more rapidly than the increase of revenue from subscribers and there really was at that time a crisis. The telephone rates were $150 a year; that was the cheapest telephone you could get in New York City, and the metallic circuit was being put in at $240 a year.

One point after another was overcome. One type of switchboard after another was devised and the telephone, instead of being greatly restricted in New York as was then feared and as it would have been if we had not made these improvements, spread out all over the city and state. Without these switchboard improvements, of course, the development could not have taken place.

One of the very gratifying developments was the removal from the subscriber's station of the crank which had to be turned and the batteries which had to be renewed. This improvement was made by the introduction of the common battery system. The old type of

instrument was an annoyance to the subscriber and a great expense to the licensee, and the introduction of the common battery system was attended with most gratifying results in the central offices, because without any additional labor, in fact with greater ease, the central office operator could handle a much larger number of calls with really less effort, with much greater promptness and without some of the worst annoyances that attended the working of the previous system. One of them was that under the old system, the operator had to be continually listening in and annoying a customer asking "Are you through?" whereas with the new system, signals are exhibited when subscribers are finished and when they want to talk, so that the operator does not have to, and, as a matter of fact, does not listen in unless the subscriber signals her to do so when he wants attention.

## The Machine Switching System

There has been a great change in the economics affecting operators. The war placed women in the work which had always been done by men, and women are now continuing in that kind of occupation. It completely changed the situation with respect to the supply of operators. Also with the increase in trunk lines and other complications, the space which an operator can reach is about exhausted and the general staff have studied the problem to see what could be done about it and that brings us to the consideration of the machine switching system, or automatic system. That has been a subject which has occupied our attention for ten or fifteen years pretty steadily, with a view to finding out what place such machinery has in the properly organized telephone system.

Our tendency has been, all the time, to introduce machinery wherever it gives a better result to the public, or wherever it can be attended by economy of any kind. The fundamentals of this system were tried out for a number of years in Newark, and the other features of it were under trial for a long time, in New York City,

for handling trunk lines. The most recent installation was at Omaha, and there much interest was exhibited as to how the subscribers would regard it. The result was that subscribers, a lot of them, sat up until 12 o'clock at night so that they could be the first to send the call. The business started off in the morning and went through almost without a hitch, and the entire comment of the public and the press was most gratifying.

### The Problem of Manufacture

In the early days there were very few sources available for the manufacture of telephone apparatus. There was a concern at Indianapolis owned by Gilliland; one at Cincinnati, Post & Company; another at Baltimore, Davis & Watts; Charles Williams & Company in Boston which was the firm that manufactured the first telephone ever made for Bell, and the Western Electric Company in New York and in Chicago.

Licenses were issued to these manufacturers but it was found that there was a great diversity in product and it was necessary to have the parts constructed so as to fit into a complete system. The telephone itself, of course, does not work in isolation. Its operation depends, not only on its own condition, but on the condition of the instrument with which the communication has been held, and on the condition of every intermediate thing in the plant, so that the discordant results in construction were very troublesome. Also, it would seem that some of these companies were not as strong as they should have been and that starting to install a switchboard, which would last fourteen or fifteen years, it was not all put in at once; the licensee companies did not put in any more than they could possibly help to save idle investment, but a manufacturing company was committed, when it put in a certain type of switchboard, to add parts to that, so that it was necessary to get some arrangement to insure continuity of supply of all the parts that were needed.

For these and for other reasons, these manufacturing companies were brought together into a single company. Very little was done with the factories at Cincinnati and Baltimore, but Williams of Boston, Gilliland of Indianapolis, and the Western Electric Company combined their talent, utilizing the best men of each concern, in fact all of their good men were selected and all the workmen that would go, and factories were established in New York City. This was the beginning of the Western Electric Company, as the manufacturing branch of the Bell System.

## Necessity for Development and Research Work

If we did not continue this work the progress would cease. I don't like to criticize any of the foreign governments, but in order to illustrate my point I must bring out the fact that where we have hundreds and hundreds of men developing, they have four or five. That is, practical development and research as we know it here in America is unknown among the government administrations abroad. They have not conducted these developments in the manner that we have here in this country. And the result is that, looking over the entire contributions that have been made to the telephone art, the developments have been made here in this country, and there has been no substantial contribution to the art that has been made by any of these governments. Now, they have departments for doing these things, but they are not done. The best that they have abroad today is what they have taken from us. But in their method of organizing, their methods of use have not been developed, because they have not had general staffs to develop these systems. Take it even in the matter of their military necessities, the general staff of the French Army under Foch was the most brilliant that was ever known, and it was well known that a communication system was necessary for the conduct of war, but when the war broke their own administration was unable to

provide them with a communication system and it was necessary for the Americans to superimpose upon France and the neighboring countries a communication system within nine months that the foreign governments had failed to provide in forty years.

Now, if we stopped this development work we would dam up progress and we would fall into a condition as bad as there is abroad. Science is constantly advancing. Our country is growing. Business is expanding. New ideas are springing up in business, and new requirements are made. We want to talk greater and greater distances. We must be prepared to talk to South America. We are already talking to Cuba. There is no doubt we will be talking to Europe. We must go on expanding. To stop now would mean that the business would have to grow, but it would be conducted with the methods that we now know, which are well adapted for the present development, but we know they are not best for the development of ten or fifteen years hence. When we start putting in a plant now we are not building it for one year or two; we are building it for a long period and we must have in mind that it must grow, and that that new growth must always be in accord with the demands of the time.

# Some Notes on Statistics

## *With Special Reference to the Telephone Business*

### The Origin of Statistics

IN the popular mind statistics is frequently looked upon as a science of recent development which deals with uninteresting figures at its best and with involved mathematical concepts at its worst. Yet the use of crude statistical methods runs back as far as recorded history; and probably the evolution of no subject is more closely interwoven with the needs and development of peoples than is that of statistics. The history of statistics through the past ages is no mere catalog of successive steps in the development of a scientific basis of recording facts, but rather is a story of persistent efforts to obtain a working knowledge of the fundamental elements in the lives of nations—first, with respect to their population and material resources and, later, with respect to their economic and social relationships also. From the earliest records of organized social and political communities, the enumeration and compilation of statistical data has played an integral and vital part in their existence. The apportionment of taxes and the organization of armies were practically impossible without some degree of statistical information concerning the resources in materials and man power of the tribe or nation. One of the earliest known statistical compilations took place about 3050 B.C. and concerned the collection of data regarding the population and wealth of Egypt in order to make arrangements for the construction of the pyramids. Both secular and sacred history are filled with instances of the taking of censuses of population in order to determine the fighting strength of nations and as a basis for levying taxes. Until the 17th or the 18th century, however, practically the sole use of such censuses was to aid the government in its administrative work or in its military aspirations.

## The Beginning of Modern Statistical Methods

Modern statistics developed from two apparently independent schools of research, one in Germany which became prominent about the middle of the 18th century and the other in England which originated about a century earlier. Statistics as first used in Germany applied to lectures or books upon descriptive political science and was considered as a science of populations, similar to what is now known as demography. Etymologically, statistics means the science of states, and not until the development of the English school of political arithmetic was statistics looked upon as primarily a study of numerical data.

Interest in statistical compilations was aroused in England during the middle of the 17th century after the disastrous visitations of the plague had caused the publication of weekly reports of the burials, and later the christenings, in London. In 1662 Captain John Graunt of London published his "Observations on the Bills of Mortality" which contained the results of his observation and measurement of the births and deaths in London and is one of the first recorded analytical studies of a strictly statistical nature. This field of study was at that time called "Political Arithmetic," but by the early part of the 19th century it had largely absorbed the descriptive political science school in Germany, from which it took over the term "statistics."

The first journal of the Royal Statistical Society, which was founded in London in 1834, defined statistics as "the ascertaining and bringing together of those facts which are calculated to illustrate the condition and prospects of society." Further expansion in the scope and meaning of statistics took place at this period, and from the name of a science or art of state-description by numerical methods the word was transferred to those figures with which it operated. When this occurred, the term soon lost its peculiar application to data concerning the

state and was used in referring to any collection of numerical data, covering psychology, biology and other sciences, as well as political economy.

Thus statistics in modern usage has come to mean primarily a method or tool by means of which numerical data in any field may be analyzed and interpreted. In its development statistics has, of course, borrowed very largely from the older science of mathematics. Using processes largely mathematical in character, the student of statistical methods formulates the rules of procedure for handling groups of data, and the specialists in various fields of knowledge apply these rules to their own particular problems.

## The Application of Statistics to Business

But while statistics has had a long and distinguished career in the service of public administration and private scientific research, it is true that the application of statistical methods of analysis to business data is a development of recent origin. This is because business administration itself has only recently taken on the aspects of a distinct science, with the process of evolution from small individual enterprises to large corporate organizations which has been coincident with the growth and improvement of transportation and communication. Moreover, the use of statistical methods in business has been facilitated by the recent progress in the invention and manufacture of mechanical labor-saving devices which have made it possible to undertake much statistical work which was formerly prohibitive from the standpoint of both cost and time. The increase in legislation affecting business has also served to stimulate the expansion of statistical work in industry. So long as business was conducted by small units, each with a limited market, there was a tendency to regard statistical work as an unnecessary luxury; but with the development of business as a science, statistical analysis is destined to play the same vital part in business administration as it has

in the progress of other sciences. Indeed, the progress made in business statistics in the last few years has been so pronounced that "statistical control" is rapidly becoming an actuality in many lines.

## Business Statistics Defined

To make clear the scope and character of that branch of statistics which has come to be called business statistics, it is perhaps advisable to attempt briefly to define "statistics" as it commonly applies to business administration.

The man in the street looks upon statistics as the systematic collection, classification and tabulation of numerical facts, and his idea of a statistician is a man who knows how many males of foreign parentage, between the ages of twenty and thirty, are employed in mining occupations in the State of Nevada. The more scientific person probably thinks of statistics as a method mathematical in its operation, in which numerical data are analyzed through complex calculations of averages, units and the like.

The business statistician himself, however, thinks of his work as the collecting, classifying and interpreting of ascertained facts—including facts not subject to numerical statement—primarily with the aim of disclosing some further and hitherto unascertained facts. He thinks of his duties as those of assembling and selecting data, analyzing and combining them, and presenting and explaining them in such a way that they tell much more than they do in their primary, unrelated form. The opportunity for work of this character obviously pervades all branches of any business organization. Moreover, the field for such statistical work is not confined merely to the analysis and interpretation of internal operating and financial data, but includes the study of general business and economic conditions and the influence of these conditions upon the individual business.

## The Development of Telephone Accounting

In considering the progress already made in the field of statistical analysis of business operations, it should be remembered that accounting work is to a large extent the basis of statistics and that the introduction of scientific accounting methods is itself a comparatively recent development. This applies to the telephone business as well as to other lines of industry.

While the telephone was invented forty-five years ago, only for the past fifteen years or so has the telephone been a widespread public service. During this period the first work was naturally the erection of an adequate accounting system to show the financial condition of the business. It was necessary to set up refined methods for the separation of capital and income, the proper treatment of depreciation, etc. Practically all available time was devoted to the development of uniform accounts and standard reports, correct plant and maintenance accounting, suitable records of departmental expenditures and forms of accounts for general publication. Along with all this, careful plans have been worked out for extending the use of accounts by administrative officers, placing in the hands of responsible officials accounts practically arranged as working tools for everyday use. In the Bell System most of this work has been accomplished during the past fifteen years, a period within which the number of company-owned telephone stations has increased from two millions to nine millions.

## The Field for Statistical Analysis of Internal Telephone Data

Under such circumstances it would be surprising if the work of statistical analysis had progressed to the same degree as the accounting work. Development of the business has gone on faster than development of the necessary statistical personnel. Thus, at the present time, the Bell System is in possession of an admirable accounting system and a comprehensive set of primary

records—operating as well as financial—but has not advanced so far in the development and application of methods of statistical analysis. The magnitude of the business has made necessary such a voluminous mass of records and reports that many useful facts as to past conditions now lie buried, while significant elements of current operations are frequently subordinated. It seems apparent, therefore, that we have reached the point where there is not so pressing a need to extend and sensitize the accounting system as a whole as there is need to proceed further with the scanning, sifting and interpreting of results now shown by the accounts and operating records, and the presentation of the significant facts, trends, ratios and units through appropriate graphical and other statistical forms. Even as close cooperation has been established between the Accounting Department and other Departments in the working up of accounting data, in like measure close cooperation can profitably be established between the Departments in the work of statistical analysis. It is a matter of general concern that all accounts are under proper check so that figures finally lodged in the balance sheet are absolutely correct according to the accounting instructions; should not equal care be taken that all accounts and operating records are subjected to suitable and adequate statistical analysis not merely as to the correctness of the figures, but as to the significance and interpretation of the figures? While the accounts show very definitely *what* has happened, statistical work is designed to show, from an analysis of operating as well as accounting data, exactly *where* it has happened, *why* it has happened, and *who* or *what* is responsible.

## The Influence of External Forces

As already indicated, the field of business statistics is by no means limited to the analysis of internal financial and operating records. One of the fundamental characteristics of present-day industrial organization is the

instability of business activity. This instability is manifested in individual businesses and in business as a whole. Business may be improving or it may be growing worse, but it is never static. Because they directly or indirectly affect profits, these fluctuations in business activity are of paramount interest to the business man; and their accurate measurement and analysis through the application of scientific statistical methods is consequently a matter of prime importance. This applies to the telephone as well as to other businesses, even though the telephone business is one of relative stability as compared with business in general.

Perhaps the most common form of analysis of business data is the comparison of crude data for a current month with corresponding figures either for the preceding month or for the same month of the preceding year, or for both. However, direct comparisons of business data either as between different months or periods of the same year, or as between the same month or periods of different years, are in most cases liable to give rise to more or less misleading conclusions, because of the presence in the crude data of the effect of two influences: namely, seasonal variation (which affects the accuracy of the comparison in the first case) and normal growth or long time trend (which affects the accuracy of the comparison in the second case).

As an illustration of this point, take an example applicable to the telephone business. Suppose, for instance, that the number of originating local calls in a certain exchange area during the month of August is reported as 3% less than the number in the preceding month of July, but 5% greater than the number in the month of August of the preceding year. This comparison of August with the preceding July does not necessarily indicate unfavorable traffic conditions or results in August; indeed, since local traffic in that month is usually less than that in July as a result of the effect of normal seasonal influences, the fact that the decrease in August as compared with July is only 3% may even indicate an

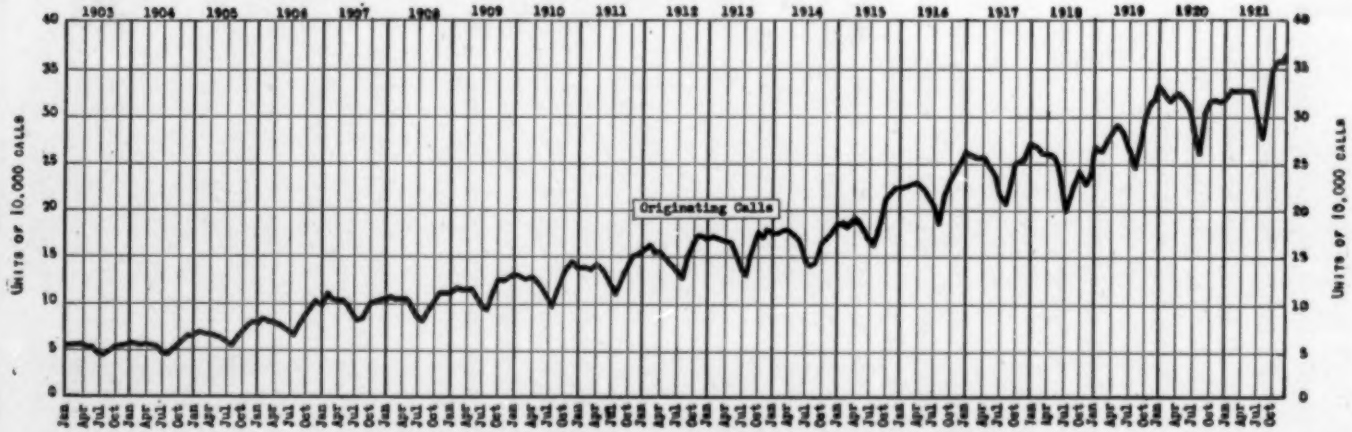
improvement in conditions. In the comparison of August with the same month of the preceding year, the element of seasonal variation is largely eliminated but no allowance is made for the element of normal growth. Thus, the fact that local traffic is 5% greater than in the same month of the preceding year does not necessarily indicate that the volume of traffic is as great as it ought to be. If the normal annual growth in local traffic in the exchange area in question happened to be in excess of 5%, the traffic results in the current August would be unfavorable rather than favorable.

## The Statistical Measurement of External Forces

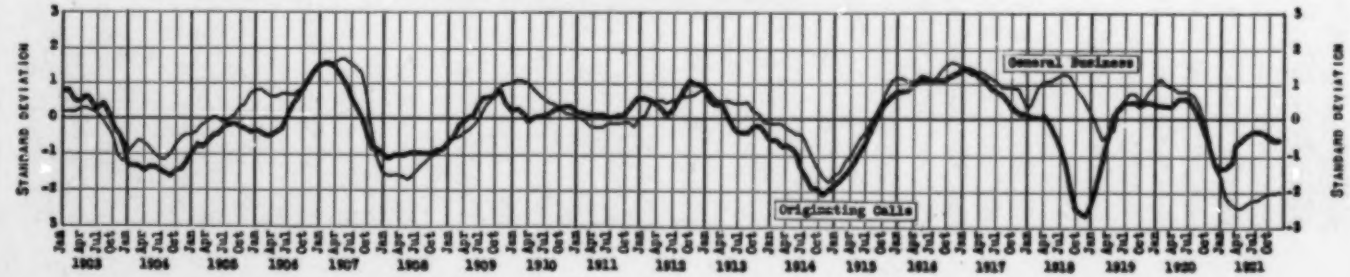
Therefore, in dealing with business data in which the influences of long time trend and seasonal variation are present, accurate conclusions can generally be reached only if the effects of these influences are eliminated. In a forthcoming Statistical Bulletin issued by the Statistical Division of the American Telephone and Telegraph Company a statistical method is described whereby the effect of these influences can be removed, the method being one which has been carefully tested both in the analysis of general business data and in the analysis of statistics of the telephone business. For purposes of explanation, figures on the monthly production of pig iron over the past 19 years are used in the Bulletin, because reliable homogeneous figures on pig iron production are available for a period of satisfactory length and because these figures are relatively free from complications which are irrelevant to a discussion of the general statistical method involved. The analysis of homogeneous series of figures within the telephone business, however, can proceed along identical lines. The accompanying chart shows the result of the application of the method to local traffic in a certain telephone exchange area.

After the effects of seasonal variation and long-time trend have been eliminated from any series of business

AVERAGE DAILY ORIGINATING CALLS IN AN EXCHANGE
(ACTUAL FIGURES)




COMPARISONS OF ORIGINATING CALLS AND GENERAL BUSINESS WITH ESTIMATED NORMALS
(LONG-TERM TREND AND SEASONAL VARIATIONS HAVE BEEN ELIMINATED)



data, the corrected figures will usually be characterized by a broad wave-like movement similar in general form, though of different amplitude, to the cyclical swings of business activity through its alternate periods of prosperity and depression. In the case of telephone data, the comparison of figures analyzed by this method (where applicable) with external indices of general business, similarly analyzed, will permit proper conclusions to be drawn as to whether the current movements reflected by the telephone figures are reasonable and satisfactory in the light of general business conditions, or whether they indicate the existence of some abnormal condition which warrants examination from an administrative standpoint. The establishment of a consistent relationship, or correlation, between two or more analyzed series of telephone figures will also prove serviceable for administrative purposes, since the development of inconsistencies in these relationships will also generally indicate the presence of some condition warranting administrative investigation.

## Statistical Aid in Forecasts

Not only is accurate analysis of past and present performance serviceable for administrative purposes and necessary for proper conclusions as to the real trend of current movements, but the measurement of the elements of long-time growth and seasonal variation by the statistical method described in the above-mentioned Statistical Bulletin affords, it is believed, an improved basis for forecasts, especially forecasts in which it is necessary to allow for the effect of general business conditions. The normal trend of long-time growth may be projected into the future and, where forecasts by months are desired, the projected annual trend may be translated into monthly figures in accordance with the normal seasonal variation. Such a projection, if limited to a period not more than five years in advance, should prove in the case of most series of telephone statistics to provide a substantially accurate forecast of future trends in so far as these

elements are concerned. If, furthermore, a fairly consistent relationship can be shown to have existed in the past between a given telephone series and some index of outside business conditions, a still more accurate forecast can be provided by modifying the figures indicated by the projected normal to allow for the influence of the probable future course of business conditions.

## Conclusion

The particular phases of statistical and accounting work discussed above do not, of course, cover the whole field for such work in the Bell System. They are cited merely to indicate in a general way the undeveloped opportunities which still exist for further application of statistical methods of analysis, and to call attention to the need for the progressive development of these opportunities. Much splendid statistical work is already established in all parts of the System, but before the field can be thoroughly covered a considerable amount of experimental work is still to be done.

S. L. Andrew.

# Progress of the Joint Committee on Relations of Supply and Signal Circuits

YOU have all heard of E. K. Hall's "Four C's Program"—Contact, Conference, Confidence, Cooperation. Once again, this time in the matter of our relations with power and lighting companies, the advantage of this method of handling questions, in which both sides have a constructive interest, is demonstrated.

For many years the problems arising from the proximity of supply (electric light and power) circuits and signaling circuits have required the attention of the engineers of both classes of public service companies and, in many cases, questions have arisen requiring also the attention of the executives. These questions have to do with relations between the two classes of circuits—at crossings, at conflicts (that is, close parallelism where there is a chance of physical contact between the wires), on jointly used poles, and in connection with inductive interference. Questions arising from the foregoing relations, and particularly from the last one, inductive interference, have been troublesome and from time to time have created controversies. Occasionally these have resulted in commission or court proceedings. Considering the magnitude of both systems and the opportunities for differences, these have been few in number, but their possibility was always present and somewhat more than a year ago the settlement of some of these questions took on a more threatening aspect. It appeared that the time had come when the industries concerned must either get together and settle the questions concerned by cooperative effort or there would be much controversy, litigation and bad feeling resulting in necessarily unfavorable reactions on the public relations and service of both parties.

Accordingly, an arrangement was perfected between the Bell System and the National Electric Light Association, the great organization of the lighting and power companies of the United States, by which a Joint Com-

mittee was appointed, this Committee consisting of men of recognized standing in both industries, so that any conclusion reached by them would be generally recognized as having the very highest standing. This Committee held its first meeting on March 26, 1921, at which meeting there was a general discussion of the questions involved and a unanimous decision that it would be to the interest of both industries to work out the questions under consideration in a friendly and cooperative spirit. A Sub-Committee of the Joint Committee consisting of R. F. Pack and Bancroft Gherardi was appointed, and proceeded in accordance with its instructions, to form a committee of engineers to assist it in analyzing the situation and to prepare a report setting forth certain principles of procedure for the treatment of situations of proximity and to recommend such further work as might be necessary. The Committee of Engineers appointed consisted of W. J. Canada, A. E. Silver and F. H. Lane for the National Electric Light Association, and H. P. Charlesworth, S. P. Grace, H. S. Osborne and H. S. Warren for the Bell System.

A second meeting of the Joint Committee was held on March 7, 1922, at which the report referred to above was received and adopted. The Joint Committee also prepared the following letter transmitting the report.

NEW YORK, March 7, 1922.

MEMBER COMPANIES OF THE N. E. L. A.
ASSOCIATED COMPANIES OF THE BELL SYSTEM.

We are sending you herewith a copy of the report of the Sub-Committee of this Committee, which report is recommended as a basis for the handling of relations between the electric light and power circuits of the N. E. L. A. Member Companies and the communication circuits of the Associated Companies of the Bell System.

As to the relations between the two classes of circuits at crossings, conflicts, and jointly used poles, the Committee recommends a definite guide to practice, subject to satisfactory agreement as to jointly used poles between the parties concerned as to terms and conditions.

As to parallel construction, general principles are recommended which show the way to a satisfactory solution of specific cases.

Your Committee has instructed a Sub-Committee consisting of M. R. Bump, R. F. Pack and Bancroft Gherardi to proceed with the further work as recommended under Section II (Standards of Construction and Operation), and to report before May 15.

Your Committee, as soon as standards of construction and operation are adopted, will consider whether principles can be established to aid in the fair allocation of the costs of coordinative measures. In the meantime, your Committee believes that with the cooperative spirit which now is evident, a mutually equitable adjustment can and should be made in each specific case. It is understood that any adjustments made will not be considered as precedents by either party to the prejudice of future understandings.

Your Committee wishes to emphasize the fact that the most important factor in this whole situation, and the one which will contribute in the greatest degree to the solution of all these questions, is close cooperative working between the two classes of companies, and the taking up and working out of problems in advance of the doing of actual construction. It is of primary importance that power and communication companies cooperate in the preparation of such plans with a view to coordinating their construction, both with respect to the immediate construction proposed and general arrangements for future development, as obviously the necessary adjustments can best be made while the work is in a paper stage. With the way clear as to how the solution of these problems may be obtained through cooperative work, it would not seem necessary, and certainly it is inadvisable, to undertake to settle such questions by resorting to controversial proceedings which necessarily produce feelings of animosity which are not limited in their influence to the particular situation in question.

In conclusion, your Committee desires to express its appreciation of the general cooperative spirit in which such questions have been handled throughout the country during the year in which your Committee has been at work in endeavoring to find a solution of the problems satisfactory and fair to both parties.

[SIGNED]

O. D. YOUNG, *Chairman*, General Electric Company, New York, N. Y.

R. H. BALLARD, Southern California Edison Company, Los Angeles, Cal.

M. R. BUMP, H. L. Doherty & Company, New York, N. Y.

H. M. BYLLESBY, Represented by R. F. PACK, H. M. Byllesby & Company, Chicago, Ill.

J. J. CARTY, American Telephone and Telegraph Company, New York, N. Y.

BANCROFT GHERARDI, American Telephone and Telegraph Company, New York, N. Y.

E. K. HALL, American Telephone and Telegraph Company, New York, N. Y.

L. H. KINNARD, The Bell Telephone Company of Pennsylvania, Philadelphia, Pa.

MARTIN J. INSULL, Middle West Utilities Company, Chicago, Ill.

ROBERT LINDSAY, Cleveland Electric Illuminating Company, Cleveland, O.

BEN S. READ, The Mountain States Telephone and Telegraph Company, Denver, Col.

PAUL SPENCER, United Gas Improvement Company, Philadelphia, Pa.

GUY E. TRIPP, Westinghouse Electric & Manufacturing Company, New York, N. Y.

M. H. AYLESWORTH, *Secretary*, National Electric Light Association New York, N. Y.

The Sub-Committee Report, with the letter given above, has been printed in full and widely distributed. The recommended plan for the solution of inductive interference situations and the conclusions of this report are quoted below.

### RECOMMENDED PLAN FOR THE SOLUTION OF INDUCTIVE INTERFERENCE SITUATIONS

I. General principles.

A. Cooperative planning for all new construction.

B. The location, construction and operation of all supply and signal circuits in conformity with generally coordinated methods, including precautionary measures which can reasonably be applied under generally prevailing conditions as distinguished from special situations.

C. Where specific coordinative measures are necessary, those providing the best engineering solution should be applied. This involves—

1. Meeting service requirements of both systems.

2. The coordinative measures applied shall be selected without regard to whether they apply to one system, or the other system or both.

3. The solution to be based as far as practicable on the state of the art at that time.

4. Measures of coordination wholly by separation should be considered with other measures of coordination where the former will not sacrifice economy and practicability and the convenience of rendering present and future service.

D. Neither party should assume to be the judge of the service requirements of the other system, or of what constitutes good practice in that system.

E. Existing cases to be cleared up in an orderly and systematic way as occasion requires in accordance with the above principles.

II. Standards of Construction and Operation in accord with the foregoing principles.

A. Adoption of more detailed principles as soon as possible for temporary use.

B. Preparation by further cooperative work based on the existing state of the art of definite standards covering all classes of inductive exposures.

III. Development Work.

As soon as it can be done without interfering with the work recommended under II above, a cooperative study of the art shall be made in order to determine what practicable measures, if any, may be developed and adopted to lessen the contributing characteristics of both systems.

## *CONCLUSIONS*

Your Sub-Committee believes that great progress has been made toward the solution of the problems arising out of the proximity of supply and signal circuits and to further promote the satisfactory working out of these situations recommends as follows:

1. That the Joint Committee, if they approve, adopt the principles and standards herein set forth and recommend them for general use by the respective utilities.
2. That special emphasis be given to the importance of working out problems of interference before definite plans are made for construction both with regard to immediate extensions and to general plans for future development.
3. That when differences do arise, every effort be made to arrive at a settlement through negotiations rather than resorting to court or commission proceedings.
4. That arrangements be made for proceeding with further cooperative studies along the lines indicated herein.

We wish to express our appreciation of the broad spirit of co-operation with which the engineers assisting us have approached this matter.

When the Joint Committee adjourned their meeting of March 7th, it was the unanimous feeling of all that "What's well begun is half done."

BANCROFT GHERARDI.

# Notes on Recent Occurrences

## Ship to Shore Radio Telephone Test, March 5

THE American Telephone and Telegraph Company conducted its first ship-to-shore radio-telephone test for the press in conjunction with the Radio Corporation of America on the evening of Sunday, March 5th. The purpose was to show the progress that has been made by the Bell System engineers toward working out the maximum value of the radio as a supplement to telephony. The test was carried on between the American Telephone and Telegraph Company's radio station at Deal Beach, New Jersey, and the United States Line Steamship *America*, homeward bound from Europe and at the time about 370 miles from Ambrose Light.

Representatives of all the New York newspapers and press associations were invited by the American Telephone and Telegraph Company to meet a group of the Company's engineers on the top floor of its Long Lines building at 24 Walker Street, New York. There direct connection was made with Deal Beach, and sitting around two long tables each guest was supplied with a telephone receiver and listened in on the conversations with the ship in the distant Atlantic, and later themselves talked with some of their friends on board.

The progress that has been made in the work was clearly revealed to the listeners when the difficulties that attended the development of radio service was exposed to them. Everyone is now familiar with the fact revealed by aviation that there are pockets in the air. That similarly there are pockets in the ether was made clear by the "faint spells" which for some time delayed the beginning of successful conversation and the sudden unaccountable interferences that at times broke into the communications. On the other hand the demonstration amply proved that the conditions of the ether have been sufficiently mastered to enable the American Telephone

and Telegraph Company to undertake a guaranteed service on business terms.

The test showed notably that two-way radio communication could be established over the same wave circuit, and that it is quite feasible to connect the radio with the regular nation-wide wire system. Thus anyone on the lines of the Bell System, anywhere in the country, using the ordinary telephone instrument, can talk at ease with friends in the middle of the Atlantic.

These important features of the test were appropriately signalized by connecting Captain William Rind of the *America* with Mr. H. B. Thayer, President of the American Telephone and Telegraph Company, in his country home near New Canaan, Connecticut. Although Captain Rind was 370 miles at sea and Mr. Thayer was talking on an ordinary line connecting with a small exchange, they could hear each other as easily as if they were in adjacent houses. After the greetings natural to the occasion, Mr. Thayer inquired what weather Captain Rind was having. He replied that the *America* had had a stormy voyage, that now after some hours of good weather the sea was beginning to pick up a bit again under a head breeze, and that he expected to reach Ambrose at about four o'clock Monday afternoon and dock by seven. Mr. Thayer then extended hearty congratulations and bid Captain Rind and his ship "Good night!"

The *America* has been specially equipped by the Radio Corporation of America in cooperation with the American Telephone and Telegraph Company for these experiments. The experiments are continuing. In these tests two-way radio telephony has in fact been accomplished over a distance of 1,600 miles. To supply a connection that far, however, cannot be guaranteed. The future depends chiefly upon equipping enough ships with the composite sets, permitting simultaneous operation of the radio telephone and the radio telegraph, so that radio telephoning will not have to be discontinued while radio telegrams are being received and sent. But

on the evening of March 5th it was made evident that long distance telephony is practicable at sea as well as on land.

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## General Carty's Address at the Civic Forum, Philadelphia, March 8, 1922

AT a meeting of the Philadelphia Forum, held in the Academy of Music on the evening of Wednesday, March 8th, John J. Carty, Vice President of the American Telephone and Telegraph Company, delivered an address on *World Electrical Communication.* General Carty recounted many of the major technical developments in telephony since the founding of the art. The telephone amplifier or loud speaker was used, so that although General Carty spoke in an ordinary tone of voice, every word that he said could be heard by every one of the more than 2,800 persons present with a clearness and ease that was surprising to them and evoked their spontaneous enthusiasm.

General Carty in his introductory remarks referred to the fact that the telephone was born in 1876, just 100 years after the founding of the Republic in the Declaration of Independence. Another striking parallel to which he called attention was that as Franklin, America's foremost electrical pioneer, was born in Boston but early moved to Philadelphia to begin his great career, so, too, the Telephone was born in Boston and came to Philadelphia at the Centennial Exposition of 1876 to receive its first notable recognition.

After the more formal part of his address General Carty had a motion picture shown depicting the assembling of a telephone instrument. The audience found it both very instructive and most amusing. General Carty then had the Academy of Music connected with the transcontinental circuit to San Francisco, and the audience by means of the amplifying of the loud speaker was impressed and entertained by conversation with the testboard men in San Francisco, by phonograph music

played in San Francisco, and by a violin solo by Miss Betty Bates, the twelve year old daughter of Harry Bates, the commercial representative of the American Telephone and Telegraph Company in California. This demonstration was notable in that it was the first in which two-way transmission had been secured across the continent over a two-wire circuit. Indeed, as Miss Bates was furnished with a telephone receiver, she was able herself to hear the applause in Philadelphia that greeted her playing.

A circuit was then set up to the offices of the *Philadelphia Public Ledger*, and the editor, John J. Spurgeon, without leaving his desk addressed the audience and read them news dispatches from Washington, Chicago, Tokio, London, and Guatemala, which would not be available to the public in the newspapers until the following morning.

The demonstrations were closed by radio broadcasting from the Bell System transmitting station at Deal Beach, New Jersey. In order to avoid the great amount of interference from electric sign and other power circuits which would be incurred if the radio receiver were installed in the city itself, it was set up at Narbeth, six miles west of Philadelphia, and the messages carried on into the Academy of Music by wire. This had the advantage of showing that the coordination of the radio and the wire systems is entirely practicable. Once more the loud speaker made every sound easily audible to every person in the audience. In this way they listened to weather reports, bugle calls, music, conversation and even radio messages from ships at sea. During these demonstrations neighboring transmitting stations very kindly refrained from sending, in order to leave the ether clear for the Philadelphia Forum.

The audience was intensely interested and showed their hearty appreciation by frequent applause. The various demonstrations of the evening had convincingly proven to them what General Carty had told them in his address that the American Telephone and Telegraph

and its Associated Companies are introducing to the world "an electrical system of communication which reaches out to the uttermost limits of the earth and carries with it the sublime hope that some day it will be utilized in bringing together the people of all nations into one common brotherhood."

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## Mr. Gifford's Address at Boston, March 9, 1922

THE Boston Directors of the American Telephone and Telegraph Company gave a dinner at the Copley Plaza Hotel in that city on the evening of Thursday, March 9th, to Mr. H. B. Thayer, the President, and Mr. W. S. Gifford, one of the Vice Presidents of that Company. About eighty of the more important Boston bankers and brokers were invited to meet and talk with Mr. Thayer.

At a meeting in the evening to which some 600 other prominent people were invited, Mr. Gifford made an address on the financial aspects of the telephone business. He pointed out that the remarkable nation-wide service of the Bell System required for its maintenance an organization employing 250,000 persons and an equipment valued at over $1,500,000,000. He showed that while the population and the business of the United States have grown about 50% since 1900, the telephone service, indicated by the number of telephones in use, had increased 900%, to 14,000,000 in the same time. The audience learned that at the present time 47% of the 195,000 stockholders of the American Telephone and Telegraph Company, holding 53% of the $555,000,000 of stock, are in New England.

Leading up to demonstrations of recent achievements, Mr. Gifford stated that the research and development work done by the scientists and engineers of the American Telephone and Telegraph Company resulted in the saving of millions of dollars to the Associated Companies and consequently to their subscribers all over the country.

Mr. F. A. Stevenson, Director of the Long Lines Department of the Bell System, then conducted a demonstration of radio telephony transmitting speaking and music from the Company's radio station at Green Harbor, Massachusetts, 40 miles away. A telephone amplifier, specially installed for the occasion, enabled every one present, sitting in their chairs and without any individual telephone receiver, to hear with perfect ease and distinctness. Neighboring transmitting stations cooperated by giving the Green Harbor-Copley Plaza demonstration right of way through the ether.

This was followed by a demonstration of the telephone service of the Long Lines Department over its two longest circuits by a roll-call from Boston to Havana, Cuba, a distance of 1,827 miles, including 100 miles of submarine telephone cable between Key West and Havana, and then a roll-call from Boston to San Francisco, a distance of 3,593 miles. In both cases the telephone amplifier enabled the audience to hear the conversation and music in Havana and in San Francisco as clearly as they could Mr. Thayer, Mr. Gifford, and Mr. Stevenson talking in their presence.

In closing Mr. Gifford confirmed Secretary Hoover's statement that the use of the radio telephone for private communication between single individuals was quite hopeless and in view of the achievements of long distance telephony entirely unnecessary. He defined the real value of wireless to be for purposes of broadcast publication and for supplementing the wire system in cases when connection by wire is impracticable as between ships at sea or between ship and shore.

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## The Patent Suit of General Squier

THE system of multiplex telephony and telegraphy now in use by the American Telephone and Telegraph Company, by which it is possible to transmit several telephone conversations and a large number of telegraph messages over one line, simultane-

ously, has been made possible only by the ingenuity and persistence of the engineers of the Bell System in overcoming the many obstacles to the use of such a system on commercial circuits, and by the advent and perfection of such inventions as the wave filter and the distortionless amplifier which are covered by patents owned by the American Telephone and Telegraph Company.

The basic requirements for such a system have long been known. There are a large number of patents, both United States and foreign, bearing dates from 1892 on, which disclose the fundamentals of such a system. Among these are the United States patents issued in January, 1911, in the name of George Owen Squier, now Major General of the Signal Corps, which he asserts are infringed by the system now in use.

These patents were taken out under the provisions of an early law which remits the government patent fees, provided the patentee stipulates that the invention may be used by government officials in government work, "or by any other person in the United States." Until recently this has been construed by every one, including the telephone company, General Squier himself and the United States Patent Office, to mean that the inventions of such patents were free to any member of the public. Subsequent to the commercial installation of carrier current systems by the telephone company, General Squier has contended for a different interpretation of that law. It is the view of the telephone company that General Squier's present interpretation of the law is erroneous and further that his acquiescence in the former interpretation during the development and installation of these commercial systems estops him from now adopting an inconsistent attitude.

The Squier patents, moreover, are believed by the telephone company to disclose no advance over the systems shown in prior patents, and it is further convinced that the telephone company's system does not infringe those patents, even assuming a margin of invention for them.

Negotiations between the telephone company and General Squier have been in progress for some time past with a view to determining what, if any, rights he has under the patents. The telephone company, on the other hand, has been anxious to accord to General Squier what credit may be due him for advancing this art and to pay him whatever his contribution might be worth, while on the other hand, it has realized that unless the patents were valid and contained features of substantial value and especially unless his title to non-government use of the patents was valid, it would not be justified in paying a substantial amount for a license under them.

As a solution of the difficulty, the telephone company has taken an option under which it may acquire the right to use the inventions of the Squier patents, if it shall be judicially determined that its views as to the validity and scope of the Squier patents and their dedication to the public, are wrong.

A suit for the determination of these questions was begun on March 14, 1922, and will be pressed to the earliest possible determination by both parties.

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## The Annual Meeting

THE annual meeting of the stockholders of the American Telephone and Telegraph Company was held at the headquarters building at 195 Broadway, New York, on March 28th and all the directors were re-elected by a vote of 3,542,132 shares, there being no dissenting votes cast.

The stockholders representation was very satisfactory, there being over 100 shareholders present in person and over 123,000 shareholders represented by proxies.

President Thayer spoke briefly on some of the matters covered by the annual report and by unanimous vote the transactions of the past year were approved.

# Organization Changes

UNDER this caption will be announced only elections or appointments to the offices of President, Vice President and General Manager with brief statements of service in the Bell System of new incumbents.

### American Telephone and Telegraph Company

*Edgar S. Bloom elected a vice president:*

Construction engineer for New York City, New York Telephone Company, 1897 to 1905; general plant superintendent, Pacific Telephone and Telegraph Company; plant superintendent for State of New York, except New York City, New York Telephone Company, 1909; general superintendent of plant operations, American Telephone and Telegraph Company, 1910; second vice president, Southwestern Bell Telephone Company, 1912; one of the receivers of the Central Union Telephone Company, 1914 to 1919; elected president, Central Union Telephone Company, 1919; president of the Indiana Bell Telephone Company and the Cleveland Telephone Company (name changed to Ohio Bell Telephone Company), vice president, Illinois Bell Telephone Company, 1920; chairman of the Board of Directors of the Ohio Bell Telephone Company and Indiana Bell Telephone Company, 1921.

### New York Telephone Company

*Eugene S. Wilson elected a vice president:*

On account of the prolonged illness of General Counsel Swayze, Mr. Wilson has taken charge of the presentation of the Company's case in the State-wide rate case. Appointed special counsel for the Southwestern Telegraph and Telephone Company, 1913; went to Chicago as special counsel for the American Telephone and Telegraph Company in the case of William A. Reed vs. American Telephone and Telegraph Company, 1914; general counsel for the Central Group at Chicago, 1916; vice president of the American Telephone and Telegraph Company, in charge of rate matters, 1920.

### Illinois Bell Telephone Company

*W. R. Abbott elected president:*

Cashier of Westchester Telephone Company (New York), 1889 to 1890; order clerk, Metropolitan Telephone and Tele-

graph Company (New York), 1890; Chicago Telephone Company, 1893, serving as order clerk, chief clerk to general superintendent, special agent in charge of rights of way and claims, superintendent of suburban division, general commercial superintendent and general manager; vice president and director, 1920.

*F. O. Hale elected vice president and general manager:*

Entered the traffic department of Bell Company operating in Eastern Pennsylvania, Ohio and West Virginia, 1903; superintendent, 1907; entered engineering department of the American Telephone and Telegraph Company, 1909; appointed chief engineer of the Southwestern Bell Telephone System, 1912; later general manager for the States of Missouri and Arkansas; appointed chief engineer of the Illinois Bell Telephone Company, 1921.

SOUTHERN BELL TELEPHONE & TELEGRAPH COMPANY AND CUMBERLAND TELEPHONE & TELEGRAPH COMPANY

*Frederick H. Reid elected operating vice president:*

Entered employ of Company as clerk in office of General Superintendent, 1902; chief clerk to General Superintendent, 1904; chief clerk to General Manager, 1907; assistant to Vice President and General Manager, 1913; assistant general manager, 1915; general manager since 1920.

WISCONSIN TELEPHONE COMPANY

*W. R. McGovern elected president:*

Entered telephone business at Milwaukee, 1901; chief engineer of the Central Group of Bell Telephone Companies, at Chicago, 1916 to 1919; general manager, Wisconsin Bell Telephone Company, 1919; vice president, 1920.

WESTERN ELECTRIC COMPANY

*Dr. Frank B. Jewett appointed vice president in charge of engineering manufacturing and service to telephone companies:*

Entered employ of the American Telephone and Telegraph Company, 1904; assistant chief engineer of the Western Electric Company, 1912, in charge of all development and research work; chief engineer, 1916; elected a vice president and director of the Company, 1921.